IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	10/802,428	§	Confirmation No.:	3515
Applicant:	Bin Zhang	§		
Filed:	03/17/2004	§		
TC/A.U.:	2621	§		
Examiner:	David N. Werner	§		
Title:	ESTIMATING MOTION TRIALS IN VIDEO IMAGE SEQUENCES	§		
Docket No.:	200314385-1 (HPC.0783US)	§		

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF PURSUANT TO 37 C.F.R § 41.37

Sir:

The final rejection of claims 1-3, 5, 7-15, 17, and 19-25 is hereby appealed.

I. REAL PARTY IN INTEREST

The real party in interest is the Hewlett-Packard Development Company, LP. The Hewlett-Packard Development Company, LP, is a limited partnership established under the laws of the State of Texas and has a principal place of business at 11445 Compaq Center Drive West, Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

II. RELATED APPEALS AND INTERFERENCES

None.

III. STATUS OF THE CLAIMS

Claims 1-3, 5, 7-15, 17, and 19-25 have been finally rejected and are the subject of this appeal.

Claims 4, 6, 16, 18, and 26-29 have been cancelled.

IV. STATUS OF AMENDMENTS

No amendment after the final rejection of October 27, 2010 has been submitted. Therefore, all amendments have been entered.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The following provides a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number and to the drawings by reference characters, as required by 37 C.F.R. § 41.37(c)(1)(v). Each element of the claims is identified by a corresponding reference to the specification and drawings where applicable. Note that the citation to passages in the specification and drawings for each claim element does not imply that limitations from the specification and drawings should be read into the corresponding claim element. Note also that the cited passages are provided as examples, as other passages in the specification or drawings not cited may also be relevant to the corresponding claim elements.

Independent claim 1 recites an article of manufacture, comprising:

a non-transitory program storage device (Fig. 5:588, 530) having stored thereon program instructions executable by a processing device to perform operations for estimating motion in an image sequence, the operations (Spec., p. 18, ¶ [0088], ln. 1-7; p. 9, ¶ [0029], ln. 1-4) comprising:

providing (Fig. 9:940) data points representing information from the image sequence (Spec., p. 13, ¶ [0057], ln. 1-3; p. 18, ¶ [0084], ln. 4-7); and

performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (Spec., p. 14, ¶ [0062], ln. 1 - ¶ [0064], ln. 6);

wherein the performing regression clustering includes:

selecting (Fig. 8:810) a number, K, of regression clusters for the data points from the image sequence (Spec., p. 17, ¶ [0083], ln. 3-5);

initializing (Fig. 8:820) regression functions for each of the K clusters to estimate motion paths in the image sequence (Spec., p. 17, ¶ [0083], ln. 5-6; p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4);

calculating (Fig. 8:830) values representing errors between the data points and corresponding ones of the K regression functions (Spec., p. 15, ¶ [0065], ln. 1-4; ¶ [0068], ln. 1; p. 17, ¶ [0083], ln. 7);

calculating (Fig. 8:840) a membership probability (Spec., p. 15, ¶ [0069], ln. 1 - ¶ [0070], ln. 1) for each data point based on the values representing errors (Spec., p. 17, ¶ [0083], ln. 7-8);

applying (Fig. 8:850) regression to recalculate the K regression functions based at least on the membership probabilities (Spec., p. 17, ¶ [0083], ln. 9-10);

determining (Fig. 8:860) whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion (Spec., p. 16, ¶ [0076], ln. 1-3; p. 17, ¶ [0083], ln. 10-12);

repeating (Fig. 8:830, 840, 850, 860) calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion (Spec., p. 17, ¶ [0083], ln. 12-16); and

using (Fig. 10:1030) motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion (Spec., p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4).

Independent claim 13 recites a system (Fig. 6:600) for estimating motion trials in video image sequences, comprising:

at least one processor (Fig. 5:510; Spec., p. 10, ¶ [0035], ln. 3-4);

an image sequence retrieval module (Fig. 6:608) for retrieving a current image and a first reference image and providing data points representing information from the current image and the first reference image (Spec., p. 11, ¶ [0037], ln. 4-6; p. 9, ¶ [0031], ln. 2-6; p. 13, ¶ [0057], ln. 1-3; p. 18, ¶ [0084], ln. 4-7); and

a motion estimator (Fig. 6:610), coupled to the image sequence retrieval module, for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (Spec., p. 11, ¶ [0038], ln. 1-5; p. 14, ¶ [0062], ln. 1 - ¶ [0064], ln. 6);

wherein the motion estimator is configured to perform regression clustering by selecting (Fig. 8:810) a number, K, of regression clusters for data points from an image sequence (Spec., p. 17, ¶ [0083], ln. 3-5) including the current image and the first reference image, initialize (Fig. 8:820) regression functions for each of the K clusters to estimate motion paths in the image sequence (Spec., p. 17, ¶ [0083], ln. 5-6; p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4), calculate (Fig. 8:830) values representing errors between the data points and corresponding ones of the K regression functions (Spec., p. 15, ¶ [0065], ln. 1-4; ¶ [0068], ln. 1; p. 17, ¶ [0083], ln. 7), calculate (Fig. 8:840) a membership probability (Spec., p. 15, ¶ [0069], ln. 1 - ¶ [0070], ln. 1) for each data point based on the values representing errors, apply (Fig. 8:850) regression to recalculate the K regression functions based at least on the membership probabilities (Spec., p. 17, ¶ [0083], ln. 9-10), determine (Fig. 8:860) whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion (Spec., p. 16, ¶ [0076], ln. 1-3; p. 17, ¶ [0083], ln. 10-12), repeat (Fig. 8:830, 840, 850, 860) calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion (Spec., p. 17, ¶ [0083], ln. 12-16) if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion(Spec., p. 17, ¶ [0083], ln. 12-16), and use (Fig. 10:1030) motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion (Spec., p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4),

wherein the image sequence retrieval module (Fig. 6:608) and motion estimator (Fig. 6:610) are executable on the at least one processor (Spec., p. 10, ¶ [0035], ln. 8-9).

Independent claim 25 recites 1 method for estimating motion in an image sequence, the method comprising:

providing (Fig. 9:940) data points representing information from the image sequence (Spec., p. 13, ¶ [0057], ln. 1-3; p. 18, ¶ [0084], ln. 4-7); and

performing, by at least one processor, regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (Spec., p. 14, ¶ [0062], ln. 1 - ¶ [0064], ln. 6),

wherein the performing regression clustering comprises:

selecting (Fig. 8:810) a number, K, of regression clusters for the data points from the image sequence (Spec., p. 17, ¶ [0083], ln. 3-5);

initializing (Fig. 8:820) regression functions for each of the K clusters to estimate motion paths in the image sequence (Spec., p. 17, ¶ [0083], ln. 5-6; p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4);

calculating (Fig. 8:830) values representing errors between the data points and corresponding ones of the K regression functions (Spec., p. 15, ¶ [0065], ln. 1-4; ¶ [0068], ln. 1; p. 17, ¶ [0083], ln. 7);

calculating (Fig. 8:840) a membership probability (Spec., p. 15, ¶ [0069], ln. 1 - ¶ [0070], ln. 1) for each data point based on the values representing errors (Spec., p. 17, ¶ [0083], ln. 7-8);

applying (Fig. 8:850) regression to recalculate the K regression functions based at least on the membership probabilities (Spec., p. 17, ¶ [0083], ln. 9-10);

determining (Fig. 8:860) whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion (Spec., p. 16, ¶ [0076], ln. 1-3; p. 17, ¶ [0083], ln. 10-12);

repeating (Fig. 8:830, 840, 850, 860) calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion (Spec., p. 17, ¶ [0083], ln. 12-16); and

using (Fig. 10:1030) motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion (Spec., p. 18, ¶ [0085], ln. 1 - ¶ [0087], ln. 4).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 1-3, 5, 7, 10-15, 17, 19 and 22-25 were rejected under 35 U.S.C. § 103(a) as unpatentable over "Motion-based Segmentation Using a Threshold Merging Strategy on Watershed Segments" (de Smet) in view of "K-Harmonic Means—A Data Clustering Algorithm" (Zhang).

B. Claims 8, 9, 20 and 21 were rejected under 35 U.S.C. § 103(a) as unpatentable over de Smet in view of Zhang and further in view of "A Video Segmentation Algorithm for Hierarchical Object Representations and its Implementation" (Hermann).

VII. ARGUMENT

The claims do not stand or fall together. Instead, Appellant presents separate arguments for various independent and dependent claims. Each of these arguments is separately argued below and presented with separate headings and sub-headings as required by 37 C.F.R. § 41.37(c)(1)(vii).

A. Claims 1-3, 5, 7, 10-15, 17, 19 and 22-25 were rejected under 35 U.S.C. § 103(a) as unpatentable over "Motion-based Segmentation Using a Threshold Merging Strategy on Watershed Segments" (de Smet) in view of "K-Harmonic Means—A Data Clustering Algorithm" (Zhang).

1. Claims 1-3, 7, 10-12, 25.

It is respectfully submitted that claim 1 is non-obvious over de Smet and Zhang.

To make a determination under 35 U.S.C. § 103, several basic factual inquiries must be performed, including determining the scope and content of the prior art, and ascertaining the differences between the prior art and the claims at issue. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 U.S.P.Q. 459 (1965). Moreover, as held by the U.S. Supreme Court, it is important to identify a reason that would have prompted a person of ordinary skill in the art to combine reference teachings in the manner that the claimed invention does. *KSR International Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1741, 82 U.S.P.Q.2d 1385 (2007).

The Examiner conceded that de Smet, the primary reference, fails to disclose performing regression clustering using a K-Harmonic Means function in the manner recited in claim 1 (as defined by the "wherein the performing regression clustering" clause of claim 1). 10/27/2010 Office Action at 5. Instead, the Examiner cited Zhang as purportedly disclosing the claimed subject matter conceded to be missing from de Smet. *Id.* at 6.

As recited in claim 1, values representing errors between the data points and corresponding ones of the K regression functions are calculated. Note that the K regression functions estimate motion paths in the image sequence. In the "using" clause of claim 1, the motion paths represented by the recalculated K regression functions are used if the changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion.

Zhang describes computing Euclidean distances between data points and cluster center positions m_k. From equation 5 on page 5 of Zhang, it is clear that m_k represents a **geometric center position** for a respective cluster *k*. On the other hand, the K regression functions of claim 1 **estimate motion paths** in an image sequence, and claim 1 recites calculating values representing errors between the data points and corresponding ones of the K regression functions that **estimate motion paths**. Examples of such values representing errors are provided on page 15, ¶ [0068], of the present application. As further noted in ¶ [0065] of the present application, an example error function as expressed in ¶ [0065] and in equation 9 is used. It is clear that, contrary to the Examiner's allegations, Zhang does not provide any teaching or hint of claimed subject matter that is clearly missing from de Smet.

In the rejection, the Examiner has made several fundamental incorrect assertions. First, the Response to Arguments section of the 10/27/2010 Office Action incorrectly argued that "a difference or distance between motion vectors" of de Smet is the claimed "error" in claim 1. *Id.*

at 3. The motion vectors of de Smet are part of a motion field between two consecutive image frames of a sequence. De Smet, § 2.1. A motion vector is calculated for each segment. *Id.*, Abstract. As explained in § 2.2 of de Smet, over-segmentation of an image is a problem. De Smet discloses a technique in which segments of the image can be merged based on similarity of respective motion vectors for the segments. *Id.*, § 2.3. Thus, according to de Smet, a difference or distance between motion vectors refers to a difference or distance between motion vectors for corresponding multiple segments of an image.

The Response to Arguments section of the 10/27/2010 Office Action argued that the "motion field" that has motion vectors in de Smet "is a set of the claimed 'motion paths'." 10/27/2010 Office Action at 3. Thus, it appears that the Examiner is equating the "motion vectors" of de Smet with the "motion paths" of claim 1. In view of the interpretation adopted by the Examiner, the difference or distance between motion vectors in de Smet would be the difference or distance between the "motion paths" of claim 1. However, claim 1 is not related to calculating differences or distances between motion paths—rather, claim 1 recites calculating values representing errors between the **data points** and corresponding ones of the K regression functions estimating motion paths.

In view of the foregoing, the allegation in the 10/27/2010 Office Action that "a difference or distance between motion vectors is the claimed 'error'" is clearly incorrect.

Another incorrect assertion made in the 10/27/2010 Office Action is the statement that the center points of Zhang "are believed to be the endpoints of the motion vectors in the [motion] field" of de Smet. 10/27/2010 Office Action at 4. This assertion is also incorrect.

The center positions, m_k, as expressed in equation 5 of Zhang, represents centers of clusters. K centers define corresponding K clusters. Zhang, § 1, ¶ 2. It is clear that the center

positions represented by equation 5 of Zhang are **geometric** center positions of the respective clusters of data points. The center positions of equation 5 of Zhang cannot be the endpoints of motion vectors of de Smet, as alleged by the 10/27/2010 Office Action on page 4. Based on a thorough review of Zhang, it is clear that the clustering performed in Zhang has nothing to do with providing motion information regarding data points. Since each center position as calculated according to the equation 5 of Zhang represents a geometric center, it is clear that such center position cannot be the endpoint of a motion vector. In fact, arguing that the center point of Zhang is the endpoint of a motion vector makes no sense in the context of Zhang. The center position of a cluster represents the actual geometric center of the cluster of data points—each motion vector in de Smet represents motion between respective segments of images in de Smet. The endpoint of such motion vector has nothing to do with the center point of a cluster of data points. Since the Examiner erred in arguing that the center points of Zhang "are believed to be the endpoints of the motion vectors" of de Smet, the obviousness rejection is further defective based on this additional error.

The Examiner also erred in arguing that the "center points are the claimed 'motion paths' or motion vectors of de Smet." *Id.* at 6. As established above, the center points of Zhang are geometric centers of clusters of data points. Zhang has nothing to do with providing motion information in an image sequence. To argue that the center points of Zhang, which represent geometric centers of data point clusters, are motion vectors or motion paths, is clearly incorrect.

In view of the foregoing, it is clear that even if de Smet and Zhang could be hypothetically combined, the hypothetical combination of the references would not have led to calculating values representing errors between the data points and corresponding ones of the K

regression functions that estimate motion paths in the image sequence, in combination with the remaining elements of claim 1.

Moreover, in view of the significant differences between the claimed subject matter and the teachings of the references, a person of ordinary skill in the art would not have been prompted to combine the teachings to achieve the claimed subject matter.

Claim 1 and its dependent claims are therefore non-obvious over de Smet and Zhang.

Independent claim 25 is allowable over de Smet and Zhang for similar reasons as claim 1.

Reversal of the final rejection of the above claims is respectfully requested.

2. Claim 5.

Claim 5 depends from base claim 1 and is allowable for at least the same reasons as claim 1. Moreover, claim 5 further recites **randomly** initializing **regression functions** for each of the K clusters. Although page 11 of Zhang refers to random initialization for the algorithms, there is no teaching or hint in this page of Zhang or anywhere else in Zhang of randomly initializing **regression functions** for each of the K clusters.

The Examiner argued that initialization of an algorithm "inherently contains an initialization of the regression function." 10/27/2010 Office Action at 8. There is no basis for this allegation of inherency. Claim 5 specifically recites **randomly** initializing regression functions for **each of the K clusters**. The Examiner has not established why initializing an algorithm as a whole would **necessarily** result in the random initialization of regression functions for respective K clusters. Therefore, the obviousness rejection of claim 5 is further defective for the forgoing reasons.

Reversal of the final rejection of the above claim is respectfully requested.

3. Claims 13-15, 19, 22-24.

Independent claim 13 is allowable over de Smet and Zhang for similar reasons as claim 1. Specifically, de Smet and Zhang fail to disclose or hint at a motion estimator for performing regression clustering using a K-Harmonic Means function, in the manner recited in the "wherein" clause of claim 13.

Claim 13 and its dependent claims are therefore non-obvious over de Smet and Zhang.

Reversal of the final rejection of the above claims is respectfully requested.

4. Claim 17.

Claim 17 depends from claim 13, and is therefore allowable for at least the same reasons as claim 13. Moreover, claim 17 is further allowable for the reasons stated above with respect to claim 5.

Reversal of the final rejection of the above claim is respectfully requested.

B. Claims 8, 9, 20 and 21 were rejected under 35 U.S.C. § 103(a) as unpatentable over de Smet in view of Zhang and further in view of "A Video Segmentation Algorithm for Hierarchical Object Representations and its Implementation" (Hermann).

1. Claims 8, 9, 20, 21.

In view of the allowability of base claims over de Smet and Zhang, the obviousness rejection of dependent claims over de Smet, Zhang, and Herrmann has been overcome.

Reversal of the final rejection of the above claims is respectfully requested.

CONCLUSION

In view of the foregoing, reversal of all final rejections and allowance of all pending claims is respectfully requested.

Respectfully submitted,

Date: March 25, 2011

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VIII. APPENDIX OF APPEALED CLAIMS

Claims 4, 6, 16, 18, and 26-29 have been cancelled.

The claims on appeal are:

1. An article of manufacture, comprising:

a non-transitory program storage device having stored thereon program instructions executable by a processing device to perform operations for estimating motion in an image sequence, the operations comprising:

providing data points representing information from the image sequence; and

performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points;

wherein the performing regression clustering includes:

selecting a number, K, of regression clusters for the data points from the image sequence;

initializing regression functions for each of the K clusters to estimate motion paths in the image sequence;

calculating values representing errors between the data points and corresponding ones of the K regression functions;

calculating a membership probability for each data point based on the values representing errors;

applying regression to recalculate the K regression functions based at least on the membership probabilities;

determining whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion;

repeating calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion; and

using motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion.

2. The article of claim 1, wherein the performing the regression clustering using the K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points further comprises providing motion vectors for the data points.

3. The article of claim 1, wherein the performing the regression clustering using the K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points further comprises providing at least one motion path for the data points.

5. The article of claim 1, wherein the initializing the regression functions for each of the K clusters further comprises randomly initializing regression functions for each of the K clusters.

7. The article of claim 1, wherein the program instructions are executable to further calculate a weighting factor for each data point based on the values representing errors between the K regression functions and the data points, wherein the weighting factor is chosen to allow the K regression functions to be optimized with less sensitivity to initialization of the K regression functions.

8. The article of claim 1 further comprising extracting data according to a predetermined criteria to provide the data points.

9. The article of claim 8, wherein the extracting data according to the predetermined criteria comprises portioning data according to color.

10. The article of claim 1, wherein the program instructions further include instructions for performing the operations comprising preparing each of the data points as x-y-coordinate data points.

11. The article of claim 1, wherein the program instructions further include instructions for performing the operations comprising using the recalculated K regression functions to render the image sequence with motion paths shown on a display.

12. The article of claim 11, wherein the using the recalculated K regression functions to render the image sequence further comprises overlaying the recalculated K regression functions on images of the image sequence to show motion between the images.

13. A system for estimating motion trials in video image sequences, comprising:

at least one processor;

an image sequence retrieval module for retrieving a current image and a first reference image and providing data points representing information from the current image and the first reference image; and

a motion estimator, coupled to the image sequence retrieval module, for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points;

wherein the motion estimator is configured to perform regression clustering by selecting a number, K, of regression clusters for data points from an image sequence including the current image and the first reference image, initialize regression functions for each of the K clusters to estimate motion paths in the image sequence, calculate values representing errors between the data points and corresponding ones of the K regression functions, calculate a membership probability for each data point based on the values representing errors, apply regression to recalculate the K regression functions based at least on the membership probabilities, determine whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion, repeat calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion, and use motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion,

wherein the image sequence retrieval module and motion estimator are executable on the at least one processor.

14. The system of claim 13, wherein the motion information regarding the data points comprises motion vectors for the data points.

15. The system of claim 13, wherein the motion information regarding the data points comprises at least one motion path for the data points.

17. The system of claim 13, wherein the motion estimator is to randomly initialize regression functions for each of the K clusters.

19. The system of claim 13, wherein the motion estimator is to further calculate a weighting factor for each data point based on the values representing errors between the K regression functions and the data points, wherein the weighting factor is chosen to allow the K regression functions to be optimized with less sensitivity to initialization of the K regression functions.

20. The system of claim 13, wherein the motion estimator is to extract data according to predetermined criteria.

21. The system of claim 20, wherein the motion estimator is to extract data according to color.

22. The system of claim 13, wherein the image sequence retrieval module is to prepare each of the data points as x-y-coordinate data points.

23. The system of claim 13, wherein the at least one processor is configured to use the recalculated K regression functions to render the image sequence with motion paths shown on a display.

24. The system of claim 23, wherein the at least one processor is configured to overlay the K regression functions on the images of the image sequence to show motion between the current image and the first reference image.

25. A method for estimating motion in an image sequence, the method comprising:

providing data points representing information from the image sequence; and

performing, by at least one processor, regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points,

wherein the performing regression clustering comprises:

selecting a number, K, of regression clusters for the data points from the image sequence;

initializing regression functions for each of the K clusters to estimate motion paths in the image sequence;

calculating values representing errors between the data points and corresponding ones of the K regression functions;

calculating a membership probability for each data point based on the values representing errors;

applying regression to recalculate the K regression functions based at least on the membership probabilities;

determining whether changes in membership probabilities or changes in the K regression functions satisfy a stopping criterion;

repeating calculating the values representing errors, calculating the membership probability, applying regression, and determining whether changes satisfy the stopping criterion if the changes in membership probabilities or changes in the K regression functions do not satisfy the stopping criterion; and

using motion paths represented by the recalculated K regression functions if the changes in membership probabilities or changes in the K regression functions satisfy the stopping criterion.

IX. EVIDENCE APPENDIX

None.

X. <u>RELATED PROCEEDINGS APPENDIX</u>

None.